NDIDATE'S
NUMBER

For the use of the Department only)

Tests
D-

Physics 30
Supp. 1965

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HIGH SCHOOL AND UNIVERSITY MATRICULATION

EXAMINATIONS BOARD

DEPARTMENTAL EXAMINATIONS, 1965
SUPPLEMENTAL

PHYSICS 30

Time — 3 hours.

Total Possible Mark — 159

DO NOT SPEND TOO MUCH TIME ON ANY ONE QUESTION.
READ THE QUESTIONS CAREFULLY.

Mathematical tables, slide rules and geometry sets may be used.

Complete solutions must be shown for all problems.

Some of the problems may be solved by scale diagrams.

Rough and finished work may be done in pencil or ink (Blue or Black).

DO NOT FOLD THIS BOOKLET.

Place your test booklet in the answer envelope in such a way that the UPPER LEFT HAND CORNER OF THE BOOKLET (Candidate's Number) shows through the SLASHED CORNER of the answer envelope.

BE SURE TO SEAL THE ENVELOPE.

"g" = 32 ft/sec/sec or 980 cm/sec/sec.
"J" = 4.2 joules/calorie or 778 ft lb wt/BTU

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CURR HIST

(For use of Sub-examiners only)

FOR ROUGH WORK

(No marks given for work in this space)

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QUAECUMQUE VERA

Values

3 **1.** A motor car is being driven at 40 mph in a direction due south, and a west wind is blowing at 20 mph. Find the apparent direction of the wind to the driver.

3 **2.** A jet fighter plane initially at rest is catapulted forward from an aircraft carrier to a speed of 90 mph in 3 sec. Calculate the acceleration in ft/sec/sec.

3 **3.** A body moves from rest with uniform acceleration and in the 6th sec of its motion it travels 77 ft. Find its acceleration.

FOR ROUGH WORK

(No marks given for work in this space)

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Values

3 **4.** An airship of total mass 1 ton is stationary in the air. With what acceleration will it start to ascend if 100 lb of ballast is thrown out?

3 **5.** A fire hose sends 40 lb of water each sec on a burning building. If the water leaves the nozzle at 200 ft/sec and does not bounce back from the building, what is the force on the wall of the building?

3 **6.** A ramp 18 ft long is inclined 30° to the horizontal. A 150 lb man ascends within 4 ft of the top of the ramp. Find the work done.

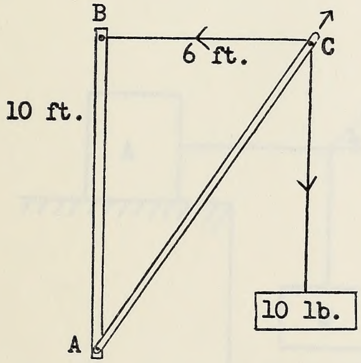
FOR ROUGH WORK

(No marks given for work in this space)

Values

3 **7.** A tennis net is tightened by means of a crank. The rope is wound around a spindle of radius 0.5 in, and the crank handle moves in a circle of radius 6 in. If the efficiency is 60%, what force exists in the rope when a player exerts a force of 25 lb on the handle in the most effective direction?

3 **8.** AC is a rod pivoted at A and kept in position by a horizontal cord BC 6 ft long. Neglecting the weight of the cord and rod, find the tension of the cord BC and the reaction of the point A when a mass of 10 lb is suspended from C.



3 **9.** A force of 20 lb wt acts along a diagonal of a square whose side is $8\sqrt{2}$ in. Find the measure of its moment about each apex.

[OVER]

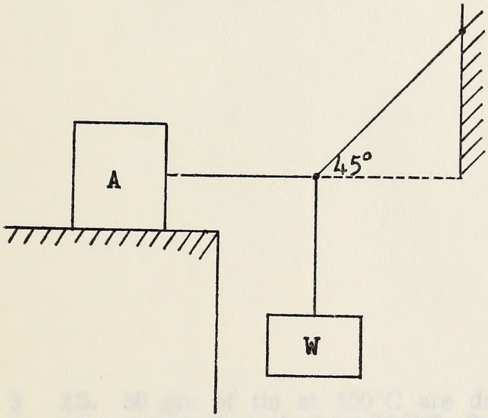
FOR ROUGH WORK

(No marks given for work in this space)

Values

3 **10.** A circular disc of radius 5 in has two circular holes, radii 1 in and 2 in cut from it. The centres of the holes lie on the same diameter, distant 3 in and 2 in respectively from the center of the disc and on opposite sides of it. Find the centre of gravity of the remaining metal.

3 **11.** Block A weighs 100 lb. The coefficient of static friction between the block and the surface on which it rests is 0.30. Find the maximum weight W for which the system will remain in equilibrium?



3 **12.** An inverted U-tube has its ends dipping into beakers containing oil and water respectively. When some air is sucked out of the tube the liquids rise to different levels. The height of the surface of oil in the tube above that in the beaker is 35.5 cm. The corresponding reading for water is 28.4 cm. Find the specific gravity of the oil.

FOR ROUGH WORK

(No marks given for work in this space)

Values

3 **13.** A copper ball (sp gr = 8.9) weighs 267 gm wt in air. What will be its weight if suspended in water?

3 **14.** A tube 6 ft long containing a little mercury and closed at both ends is rapidly inverted 50 times. What is the maximum rise in temperature of the mercury that can be expected? Sp Ht of Hg = 0.033.

3 **15.** 30 gm of tin at 100°C are dropped into 60 gm of water at 17.8° C and the temperature rises to 30.0°C. Calculate the sp ht of tin.

FOR ROUGH WORK

(No marks given for work in this space)

Values

3 **16.** 40 gm of water at 10°C are contained in a calorimeter. On adding 75 gm of water at 50°C, the temperature becomes 35°C. What is the water equivalent of the calorimeter?

3 **17.** Research has indicated that humans can stand an air temperature of 900°F for over a minute, if insulated with clothing about 1 cm thick. Express this air temperature on the Centigrade scale.

3 **18.** A bar of steel measures 2½ ft at 15°C and is longer by 0.027 in at 90°C. Calculate the coefficient of linear expansion of steel.

FOR ROUGH WORK

(No marks given for work in this space)

Values

3 **19.** Calculate the force in grams weight between two charges +81 and –109 esu placed 3.0 cm apart.

3 **20.** In a water voltameter 56 cc of hydrogen are set free in 30 min. Calculate the strength of the current, if the density of the hydrogen is 0.000090 gm/cc.

3 **21.** What is the specific resistance of a conductor of cross-section 1.0 mm^2 if 10 meters of it have a resistance of 10 ohms?

[OVER]

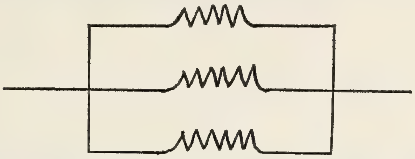
FOR ROUGH WORK

(No marks given for work in this space)

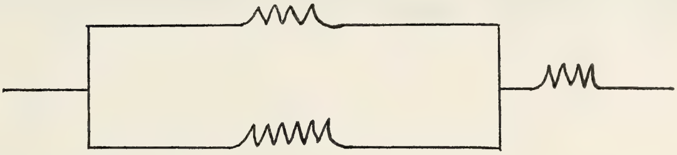
Values

22. Three equal resistors, each of resistance of 6 ohms, can be connected in three different ways. What is the resistance of each combination?

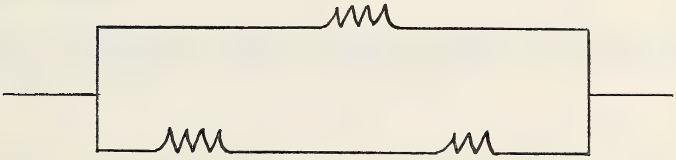
1 (a)



1 (b)



1 (c)



3 **23.** A series motor has a resistance of 1.2 ohms and the potential difference applied to it is 200 volts. If the back EMF in its windings is 164 volts, what is the current flowing through it?

3 **24.** A lamp is rated at 230 volts, 60 watts. Find the cost of using this lamp for 500 hours if the cost of electrical energy is 3¢/kwh.

FOR ROUGH WORK

(No marks given for work in this space)

Values

25. Simple Pendulum:

1 (a) If the length of the pendulum were measured from the point of suspension to the bottom of the bob, what effect would this have on the value of "g"?

1 (b) The value of "g" is found to be 981 cm/sec/sec using a pendulum bob of mass 50.0 gm. What should be the value of "g" obtained in a similar experiment using a bob of mass 60.0 gm and the same shape and volume?

26. Wheatstone Bridge

1 (a) Why is it advisable to have a rheostat in series with the galvanometer before proceeding to find the "null or dead point"?

1 (b) Why should the value of the known resistance be chosen such that the "null or dead point" is near the middle of the scale?

1 (c) Why will no current flow through the galvanometer when the contact key is at the "null or dead point"?

1 (d) Why is it advisable to exchange the known resistance and the unknown resistance and then average the results obtained to get a value for the unknown resistance?

FOR ROUGH WORK

(No marks given for work in this space)

Values

7 **27.** A piece of pipe rolls crosswise in a freight truck with a speed of 10 ft/sec, while the truck is travelling forward with a speed of 45 mph. Find the magnitude and direction of the velocity of the pipe with respect to the ground while it is rolling.

6 **28.** From the top of a tower a stone thrown vertically downward with a velocity of 40 ft/sec reaches the ground in half the time it would have taken if it had been thrown vertically upward with the same initial velocity. Find the height of the tower.

[OVER]

FOR ROUGH WORK

(No marks given for work in this space)

Values

8 **29.** A mass weighing 30 lb wt will just rest on a plane of inclination 30° to the horizontal when it is supported by a pull of 6 lb wt acting upwards along the plane. Find the coefficient of friction.

30. A box of mass 10 lb takes 4.0 sec to slide down an inclined plane of length 50 ft and height 30 ft.

2 (a) What was the potential energy of the box at the top of the incline?

3 (b) What was the kinetic energy of the box at the bottom of the incline?

2 (c) Explain why there is a difference in the two answers.

FOR ROUGH WORK

(No marks given for work in this space)

Values

7 **31.** Four masses of 4.0, 6.0, 8.0 and 12 lb are placed along a 6.0 ft uniform straight bar at equal distances of 2.0 ft. If the bar weighs 10 lb wt find the position of the center of gravity of the system.

6 **32.** A weight of 50 lb is supported in equilibrium by two ropes. One rope pulls in a horizontal direction and the other in a direction of 60° with the horizontal. Compute the tension in each rope.

FOR ROUGH WORK

(No marks given for work in this space)

Values

7 **33.** A motor supplies 0.40 hp to stir 8.0 gal of water. Assuming that all the work done goes into heating the water, how long will it take to raise the temperature of the water 10 Fahrenheit degrees? (1 gal of water weighs 10 lb wt)

6 **34.** In measuring the coefficient of expansion of mercury in a glass vessel the following readings are taken: t= 18° C, V = 25.04 cc. At the boiling point of water, V = 25.38 cc, pressure = 76 cm of mercury; linear expansion of glass = 0.0000085/° C. What is the real coefficient of expansion of mercury?

[OVER]

FOR ROUGH WORK

(No marks given for work in this space)

Values

5 **35.** 100 gm of a certain metal (sp ht = 0.095) are heated to 100° C and put into 150 gm of liquid at 10° C contained in a copper calorimeter of water equivalent of 5.0 gm. The temperature rises to 20° C. Find the specific heat of the liquid.

8 **36.** Three point charges of +30, +40, and +50 esu are at the vertices of an equilateral triangle of side 10 cm. What is the magnitude and direction of the force acting on the +50 esu charge due to the other two charges?

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DEPARTMENTAL EXAMINATIONS GRADE
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FOR ROUGH WORK

marks given for work in this space)

Values

7 **37.** Two dry cells, each having an EMF of 1.5 volts and an internal resistance of 0.60 ohm, are to be connected in such a manner as to supply as large a current as possible to an external circuit. Should the cells be connected in series or parallel if the external circuit has a resistance of 0.10 ohm? Show your calculations.

7 **38.** An electric heater of 25 ohm resistance is placed in 500 gm of water contained in a metal calorimeter of mass 50 gm and specific heat of 0.10. A current is passed through the heater for 7.0 min. What is the current if the temperature of the water rises 40° C?

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Departmental examinations,
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